WHAT IS CLAIMED IS:

1. An apparatus for converting a plurality of dc input voltages from a plurality of voltage sources to at least one dc output voltage, the apparatus comprising:

a plurality of voltage inputs;

a respective current-conducting-bidirectional-voltage-blocking switch in an electrical path from each of said voltage inputs;

a magnetically inductive device in an electrical path from each of said current-conducting-bidirectional-voltage-blocking switches; and

a voltage output in an electrical path from said magnetically inductive device.

2. The apparatus recited in claim 1, wherein

said voltage output comprises one of a plurality of said voltage outputs.

3. The apparatus recited in claim 1, wherein

said magnetically inductive device comprises an inductor.

4. The apparatus recited in claim 1, wherein

said magnetically inductive device comprises a transformer.

5. The apparatus recited in claim 4, wherein

said voltage output is reversed in polarity relative to one of said voltage inputs.

6. The apparatus recited in claim 4, wherein

said voltage output is bucked relative to one of said voltage inputs.

7. The apparatus recited in claim 4, wherein

said voltage output is boosted relative to one of said voltage inputs.

8. The apparatus recited in claim 1 in an electrical path with a secondary converter, the apparatus having said voltage output fed back to one of said plurality of said voltage inputs through said secondary converter.

9. The apparatus recited in claim 1 wherein

each of said current-conducting-bidirectional-voltage-blocking switches is switched on substantially simultaneously with a switch signal;

each of said current-conducting-bidirectional-voltage-blocking switches has a different duty cycle;

a voltage index i is assigned to each voltage source connected to a voltage input of plurality of said voltage inputs such that $V_1 > V_2 > \dots V_n$; and

each of said current-conducting-bidirectional-voltage-blocking switches has an effective duty cycle $D_{eff(i)}$ of

$$D_{eff(i)} = \begin{cases} 0, & D_i < \sum_{j=1}^{i-1} D_{eff(j)} \\ D_i - \sum_{j=1}^{i-1} D_{eff(j)}, & D_i \geq \sum_{j=1}^{i-1} D_{eff(j)} \end{cases}$$

such that a voltage at the voltage output V_o is

$$V_o = \frac{\sum_i D_{eff(i)} V_i}{1 - \max_i (D_i)}.$$

10. The apparatus recited in claim 9, further comprising:

an input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches.

11. The apparatus of claim 1 wherein

a current through said magnetically inductive device, said magnetically inductive device having an inductance L, is greater than zero in steady state operation;

each of said current-conducting-bidirectional-voltage-blocking switches is switched on and off with a binary switching signal having a value of 1 or 0;

said voltage output is connected to a resistive load R;

only one of each of said current-conducting-bidirectional-voltage-blocking switches is switched on in any given period of time T, such that

a current in the magnetically inductive device i_p is

$$i_p = \sum_j \left|\Delta i_j\right| = \frac{T}{L} \sum_j D_{eff(j)} V_j ,$$

and

a voltage at the voltage output V_{out} is

$$V_{out} = i_p \sqrt{\frac{RL}{2T}} .$$

12. The apparatus recited in claim 11, further comprising:

input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches.

13. The apparatus recited in claim 1, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

14. The method recited in claim 1, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

15. An apparatus for providing dc power from more than one source to at least one load, the apparatus comprising:

a magnetically inductive device;

a plurality of inputs for respective sources in parallel through respective current-conducting-bidirectional-voltage-blocking switches to said magnetically inductive device; and

at least one output for at least one load in parallel with a capacitor in series with a diode to said magnetically inductive device.

16. The apparatus recited in claim 15, further comprising:

input control circuitry in electrical paths to said respective current-conducting-bidirectional-voltage-blocking switches for switching said respective current-conducting-bidirectional-voltage-blocking switches to open and close said electrical paths from said inputs to said magnetically inductive device.

17. The apparatus recited in claim 16 wherein said input control circuitry closes at most only one of said respective current-conducting-bidirectional-voltage-blocking switches at a given time.

18. The apparatus recited in claim 16 wherein said input control circuitry closes up to all of said respective current-conducting-bidirectional-voltage-blocking switches at a given time.

19. The apparatus recited in claim 15 wherein

said magnetically inductive device comprises a transformer, said transformer comprising

at least one primary winding and

at least one secondary winding;

the apparatus further comprises

at least one bidirectional output

in an electrical path in parallel through an additional current-conducting-bidirectional-voltage-blocking switch from said at least one secondary winding of said magnetically inductive device, and

in an electrical path to an input of said plurality of inputs; and

bidirectional control circuitry for switching said additional current-conducting-bidirectional-voltage-blocking switch.

20. The apparatus recited in claim 19 wherein

said load that may serve as a source comprises a rechargeable battery.

21. The apparatus recited in claim 15 wherein said magnetically inductive device comprises a transformer including

at least one primary winding and

at least one secondary winding.

22. The apparatus recited in claim 15 wherein

said transformer includes a plurality of secondary windings and

said at least one output includes respective outputs in electrical paths to each of said plurality of secondary windings.

23. The apparatus recited in claim 15 wherein

at least one output includes

at least one output in an electrical path to a primary winding of said at least one primary winding and

at least one output in an electrical path to said at least one secondary winding.

24. The apparatus recited in claim 15, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

25. The method recited in claim 15, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

26. A system for supplying power to a load from a plurality of sources, the system comprising:

a plurality of sources;

a respective voltage input in an electrical path from each of said plurality of said loads;

a respective current-conducting-bidirectional-voltage-blocking switch in an electrical path from each of said voltage inputs;

input control circuitry in an electrical path to each of said respective current-conducting-bidirectional-voltage-blocking switches for controlling switching of said current-conducting-bidirectional-voltage-blocking switches;

a magnetically inductive device in an electrical path from each of said current-conducting-bidirectional-voltage-blocking switches; and

a voltage output in an electrical path from said magnetically inductive device.

27. The apparatus recited in claim 26, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a forward-conducting-bidirectional-blocking switch.

28. The method recited in claim 26, wherein

said current-conducting-bidirectional-voltage-blocking switch comprises a bidirectional-conducting-bidirectional-blocking switch.

29. A system for substantially equalizing the charges of a plurality of rechargeable voltage sources, the system comprising:

a plurality of rechargeable voltage sources arranged serially in an electrical path;

respective voltage inputs in respective electrical paths to all excepting at least one of said rechargeable voltage sources;

respective current-conducting-bidirectional-voltage-blocking switches in respective electrical paths to said all excepting at least one of said plurality of rechargeable voltage sources;

a magnetically inductive device in an electrical path with said current-conducting-bidirectional-voltage blocking switches;

an output comprising a voltage input and a current input, said output in parallel with a capacitor in series with a diode to said magnetically inductive device;

wherein said current output is fed back to a rechargeable voltage source that is not comprised in said all excepting at least one of said rechargeable voltage sources.

30. The system recited in claim 29 further comprising:

a load in an electrical path to said output.

31. A method for selectively connecting a plurality of voltage input sources that are in an electrical to a magnetically inductive device, the magnetically inductive device being in an electrical path to at least one load, the method comprising:

accepting a signal to select one or more of said plurality of voltage input sources; and

based upon said signal, selectively blocking up to all of said plurality of voltage input sources from said magnetically inductive device.

32. The method recited in claim 31, further comprising:

sensing a current in said magnetically inductive device.

33. The method recited in claim 32, wherein

said sensing is performed with only a single sensor.

34. The method recited in claim 31, further comprising:
decoding of said signal to obtain a switching state.

35. The method recited in claim 34, further comprising:
determining a current coming into each of said voltage input sources.

36. The method recited in claim 35, wherein
said determining comprises decomposing said current in said magnetically inductive device based upon said switching state.